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Interactive effects of CO₂ enrichment and N fertilization on N-acquisition, -remobilization and grain protein concentration in wheat

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Abstract

The rise of the atmospheric CO₂ concentration ([CO₂]) improves wheat growth and yield but affects grain protein concentration (GP%) by decreasing gluten concentration and thus baking quality. The reasons for the negative CO₂-effect on grain quality are still under debate. It is discussed that the decrease of GP% under elevated [CO₂] results from growth dilution and /or a reduction of N acquisition. The objectives of this project are to investigate the N-acquisition and remobilization to the grain to understand the processes involved in the decrease of GP% under FACE.

We have started a two-year (2014-2015) FACE-experiment (400 ppm/600 ppm) with winter wheat grown at three N levels (ca. 60/200/340 kg ha⁻¹) and under well watered conditions.

During the growing period in 2014 destructive plant sampling was done once a month until grain maturity and crop growth and N% of different plant fractions were measured.

Seasonal course of LAI strongly depended on N supply and was hardly influenced by CO₂ enrichment. [CO₂] elevation increased leaf and stem biomass by ca. 5 – 14 %, but the CO₂ effect did not increase with N supply as expected. N% in green leaves was slightly more decreased by [CO₂] elevation than N% in stems. Total amount of N in the shoot at anthesis strongly increased with N supply and CO₂ enrichment had a smaller effect (+4 %) at the highest N level than at 60 and 200 kg N ha⁻¹ (+10%).

In addition, data from the first test year on N remobilization and on GP% will be presented.

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Keywords: wheat; grain nitrogen; CO₂ concentration; remobilization of nitrogen; FACE

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